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$$2e = \sum_{k=1}^{k=\infty} \frac{k^2}{k!}, \quad 5e = \sum_{k=1}^{k=\infty} \frac{k^3}{k!}, \quad 15e = \sum_{k=1}^{k=\infty} \frac{k^4}{k!}, \quad 52e = \sum_{k=1}^{k=\infty} \frac{k^5}{k!}, \quad 203e = \sum_{k=1}^{k=\infty} \frac{k^6}{k!}, \quad 877e = \sum_{k=1}^{k=\infty} \frac{k^7}{k!},$$

$$4140e = \sum_{k=1}^{k=\infty} \frac{k^8}{k!}, \quad 21147e = \sum_{k=1}^{k=\infty} \frac{k^9}{k!}, \quad 115975e = \sum_{k=1}^{k=\infty} \frac{k^{10}}{k!}.$$

Also solved by *G. B. M. ZERR*.

GEOMETRY.

160. Proposed by *G. B. M. ZERR*, A. M., Ph. D., Professor of Chemistry and Physics in The Temple College, Philadelphia, Pa.

Let GFH be the spherical triangle formed by joining the mid-points of the sides of the spherical triangle ABC ; E the spherical excess of ABC ; β , p the base and altitude of GFH . Prove $\sin \frac{1}{2}E = \sin \beta \sin p$.

Solution by *G. B. M. ZERR*, A. M., Ph. D., Professor of Chemistry and Physics in The Temple College, Philadelphia, Pa.

Let $BA=c$, $GF=\gamma$, $FH=\beta$, $GH=\delta$, $GP=p$.

Draw AL , BM , CK perpendicular to $DGFC$. Now $DABE = DGFE = \pi$.

$AD=BE=\frac{1}{2}(\pi-c)$, $DL=ME$, $LG=$

CK , $KF=FM$.

$\therefore 2(DL + GK + KF) = \pi$. Also $2GK + 2KF = 2\gamma$.

$\therefore 2DL + 2\gamma = \pi$, or $DL = \frac{1}{2}\pi - \gamma$.

$\angle DAL = \angle EBM$, $\angle LAG = \angle GCK$,
 $\angle KCF = \angle FBM$.

$\therefore 2\angle DAL + C + A + B = 2\pi$.

$\therefore \angle DAL = \pi - \frac{1}{2}(A + B + C) = \pi - s = \frac{1}{2}(\pi - E)$.

$\cos DAL = \sin D \cos DL$. $\cos \frac{1}{2}(\pi - E) = \sin D \cos(\frac{1}{2}\pi - \gamma)$.

$\therefore \sin \frac{1}{2}E = \sin D \sin \gamma$.

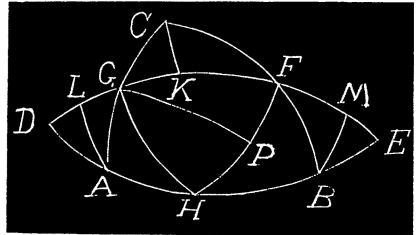
Now $\sin D : \sin DFH = \sin \beta : \sin DH$. But $DH = \frac{1}{2}\pi$.

$\therefore \sin D = \sin \beta \sin DFH$. But $\sin p = \sin \gamma \sin DFH$.

$\therefore \sin D = (\sin \beta \sin p) / \sin \gamma$.

$\therefore \sin \frac{1}{2}E = \sin \beta \sin p$.

Also solved by *J. SCHEFFER* and *L. C. WALKER*.



161. Proposed by *MARCUS BAKER*, U. S. Coast and Geodetic Survey Office, Washington, D. C.

A circle, radius r , is inscribed in a triangle ABC . In the angles A , B , and C are inscribed circles each touching two sides and the inscribed circle. There are six such circles. The first group of three have their centers between the in-centers and the vertices, and the second group of three does not. Let r_a , r_b , r_c denote the radii of the first group. Then this well known relation holds : $r = \sqrt{(r_a r_b)} + \sqrt{(r_b r_c)} + \sqrt{(r_c r_a)}$. Let R_a , R_b , R_c denote the radii of the second group. Then this relation holds :